SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2019

DCC5163: THEORY OF STRUCTURES

TARIKH : 30 OKTOBER 2019
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (4 soalan)
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A: 50 MARKS
BAHAGIAN A: 50 MARKAH

INSTRUCTION:
This section consist of **TWO (2)** structured questions. Answer **ALL** question.

ARAHAN:
*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

Figure A1 shows a truss that is supported at A and B. The truss is subjected to a horizontal load of 80kN at joint F. Given cross-sectional area, A for all members are 1200mm^2 and Young Modulus, E is 210 GPa.

Rajah A1 *menunjukkan kekuda disokong di A dan B. Kekuda ini di kenakan beban 80kN pada sambungan F. Diberi luas keratan rentas, A untuk semua anggota adalah 1200mm^2 dan Modulus Young, E adalah 210 GPa.*

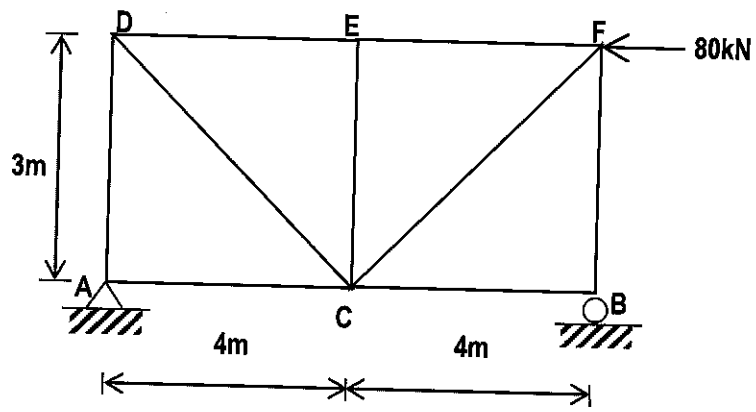


Figure A1 / *Rajah A1*

CLO2 C1 (a) Identify the internal force in each member of the truss due to external forces.
Kenalpasti nilai daya dalaman bagi setiap anggota kekuda ini terhadap daya luaran yang dikenakan .

[8 marks]
[*8 markah*]

CLO2
C2

(b) Determine the value of internal forces due to the vertical 1 unit load at joint E.
Kirakan nilai daya dalaman yang disebabkan oleh beban 1 unit secara pugak pada sambungan E.

[7 marks]
[*7 markah*]

CLO2
C3

(c) Calculate total vertical displacement at joint E.
Kirakan jumlah anjakan pugak pada titik E.

[10 marks]
[*10 markah*]

QUESTION 2
SOALAN 2

A beam in **Figure A2** is subjected to a series of moving load 50kN, 70kN and 60kN respectively. The beam is a simply supported beam that is supported at A and B. By using Influence Line Diagram;

*Sebuah rasuk seperti ditunjukkan dalam **Rajah A2** dikenakan satu siri beban bergerak 50kN, 70kN dan 60kN. Rasuk ini adalah rasuk sokong mudah yang di sokong di A dan B. Dengan menggunakan Gambarajah Garis Imbas ;*

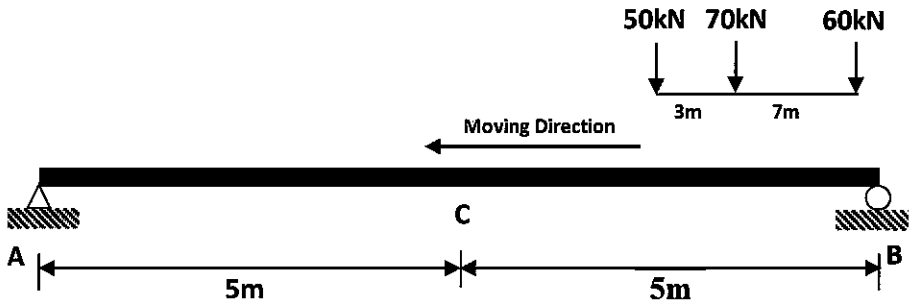


Figure A2 / *Rajah A2*

CLO3 C3 (a) Draw Influence Line for Shear Force and Bending Moment at point C.
Lakarkan Garis Imbas untuk Daya Ricih dan Momen Lentur pada titik C.

[7 marks]
[*7 markah*]

CLO3 C4 (b) Analyze the **Maximum Moment at point C** due to a series of loads moving from right to left.
*Analisis **Momen Maksimum pada titik C** yang disebabkan oleh pergerakan satu siri beban dalam satu arah dari kanan ke kiri.*

[8 marks]
[*8 markah*]

CLO3
C5

(c) Evaluate the **Absolute Maximum Moment** due to a series of loads moving from right to left.

*Nilaikan **Momen Maksimum Mutlak** yang disebabkan oleh pergerakan satu siri beban dalam satu arah dari kanan ke kiri.*

[10 marks]
[*10 markah*]

SECTION B: 50 MARKS
BAHAGIAN B: 50 MARKAH

INSTRUCTION:
This section consists of **FOUR (4)** structured questions. Answer **TWO (2)** questions only.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1
SOALAN 1

Figure B1 shows statically indeterminate beam with three spans which are supported at A, B and C. By Using Slope Deflection Method;

Rajah B1 *menunjukkan rasuk yang tidak boleh tentu statik yang di sokong pada penyokong A, B dan C. Dengan menggunakan Kaedah Cerun Pesongan ;*

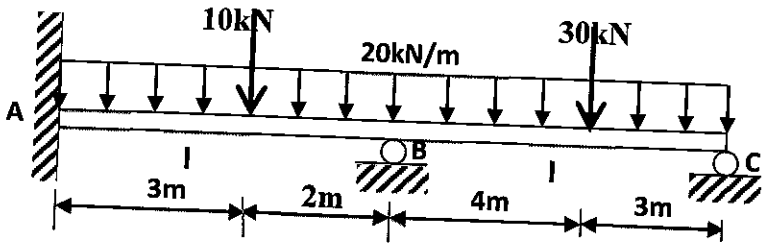


Figure B1 / *Rajah B1*

CLO1 C1 (a) Identify the value of Fixed End Moment (FEM).
Kenalpasti nilai Momen Hujung Terikat (MHT).

[4 marks]
[*4 markah*]

CLO1 C2 (b) Describe the moment equation for each span of the beam.
Terangkan persamaan momen bagi setiap rentang rasuk.

[6 marks]
[*6 markah*]

CLO1 C3 (c) Calculate the final moment at support A, B and C.
Kirakan Momen Akhir pada penyokong A, B dan C.

[15 marks]
[*15 markah*]

QUESTION 2
SOALAN 2

A non-sway portal frame with uniform EI is shown in **Figure B2**.

Sebuah kerangka portal tanpa huyung dengan nilai EI yang seragam ditunjukkan di ***Rajah B2****.*

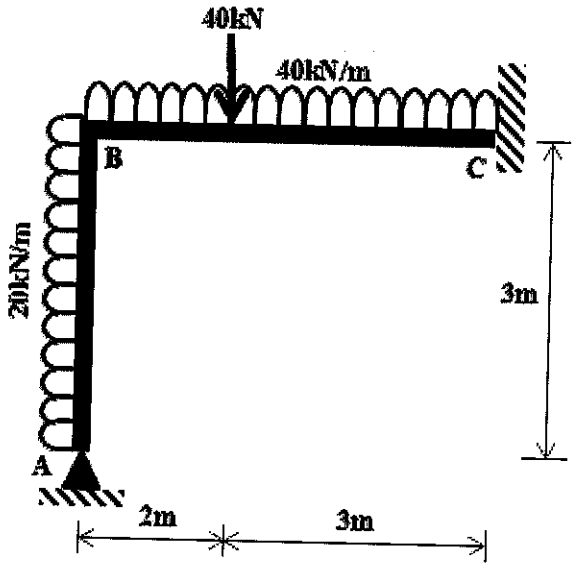


Figure B2 / *Rajah B2*

CLO1 C1 (a) Identify the value of Fixed End Moment for all spans.

Kenalpasti nilai Momen Hujung Terikat pada setiap rentang.

[4 marks]
[*4 markah*]

CLO1 C2 (b) Determine slope deflection equation.

Kirakan persamaan cerun pesongan.

[6 marks]
[*6 markah*]

CLO1 C3 (c) Calculate final moment at each joint for the portal frame.

Kirakan momen akhir pada setiap sambungan untuk kerangka tersebut.

[15 marks]
[*15 markah*]

QUESTION 3
SOALAN 3

The entire length of continuous beam A, B, C and D is loaded at positions as shown in **Figure B3**. Given the value of Fixed End Moments and Distribution Factor as follows:

*Keseluruhan rentang rasuk selanjar A, B, C dan D dibebankan di kedudukan seperti dalam **Rajah B3**. Nilai-nilai momen hujung terikat dan faktor agihan diberikan sebagai berikut:*

Fixed End Moment

M^F_{AB} = -10kNm, M^F_{BA} = +10kNm,

M^F_{BC} = -41.67 kNm, M^F_{CB} = +41.67 kNm,

M^F_{CD} = -10kNm, M^F_{DC} = +10kNm

Distribution Factor

D^F_{AB} = 0, D^F_{BA} = 5/7,

D^F_{BC} = 2/7, D^F_{CB} = 8/23,

D^F_{CD} = 15/23, D^F_{DC} = 1

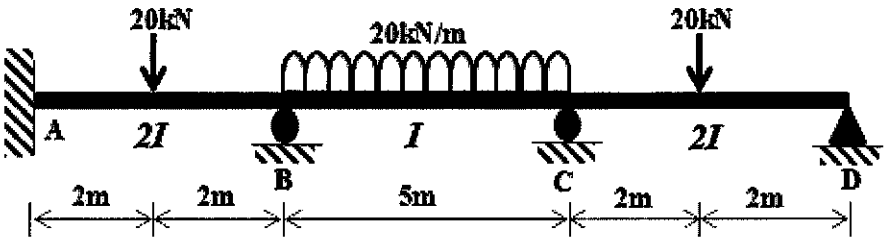


Figure B3/ *Rajah B3*

CLO1 C1

(a) Identify the Final Moments by using moment distribution method with **TWO (2)** times of distributions.

*Kenalpasti nilai-nilai momen akhir menggunakan kaedah agihan momen dengan **DUA (2)** kali agihan.*

[4marks]
[*4 markah*]

CLO1 C2

(b) Determine the reactions at joint A, B and C.

Tentukan daya-daya tindakbalas di sambungan A, B dan C.

[6 marks]
[*6 markah*]

CLO1 C3

(c) Draw shear force diagram and bending moment diagram.

Lakarkan gambarajah daya ricih dan momen lentur.

[15 marks]
[*15 markah*]

QUESTION 4
SOALAN 4

The structure shown in **Figure B4** is a non-swaying portal frame.

*Struktur yang ditunjukkan dalam **Rajah B4** adalah sebuah kerangka portal tanpa huyung.*

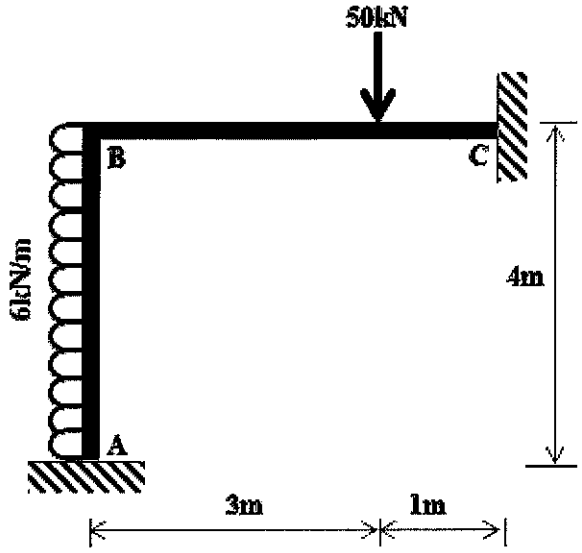


Figure B4/ *Rajah B4*

CLO1 C1

(a) Identify the value of fixed end moment for all spans.

Kenalpasti nilai momen hujung terikat pada setiap rentang.

[4 marks]
[*4 markah*]

CLO1 C2

(b) Calculate the Final Moments by using moment distribution method.

Kirakan nilai-nilai Momen Akhir menggunakan kaedah agihan momen.

[6 marks]
[*6 markah*]

CLO1
C3

(c)– By using the Final Moment from the above question;

Dengan menggunakan nilai Momen Akhir dari soalan di atas;

i. Determine the reactions at joints A, B and C

Tentukan daya-daya tindakbalas di sambungan A, B dan C

[5 marks]
[*5 markah*]

ii. Draw shear force diagram and bending moment diagram.

Lakarkan gambarajah daya ricih dan momen lentur

[10 marks]
[*10 markah*]

SOALAN TAMAT

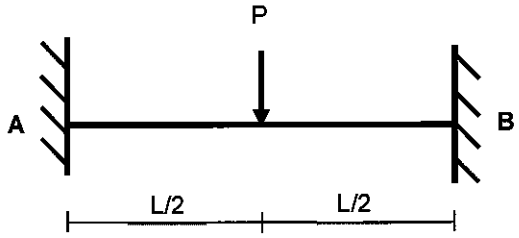
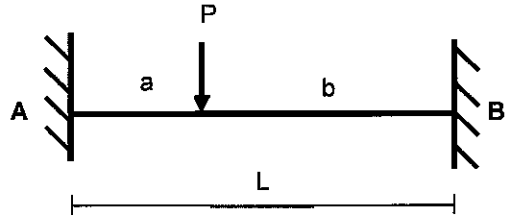
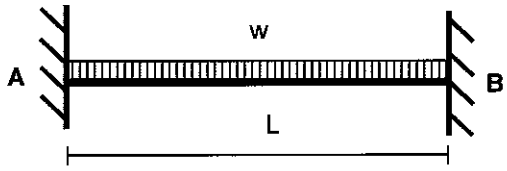
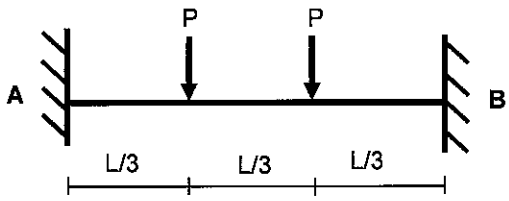
DCC5163 – THEORY OF STRUCTURES

FORMULAE

1. Slope Deflection Method

$$M_{AB} = \frac{2EI}{L}\left(2\theta_A + \theta_B - \frac{3\Delta}{L}\right) \pm M^F$$

$$M_{BA} = \frac{2EI}{L}\left(2\theta_B + \theta_A - \frac{3\Delta}{L}\right) \pm M^F$$

$M^F_{AB} = -PL/8$		$M^F_{BA} = PL/8$
$M^F_{AB} = -Pab^2/L^2$		$M^F_{BA} = Pba^2/L^2$
$M^F_{AB} = -wL^2/12$		$M^F_{BA} = wL^2/12$
$M^F_{AB} = -2PL/9$		$M^F_{AB} = 2PL/9$

2. Moment Distribution Method

i. Stiffness Factor

$K = 4EI / L$ (for Fixed or Continuous)

$K = 3EI / L$ (for Pinned or Roller)

ii. Distribution Factor

$DF = K / \sum K$

3. Statically Indeterminate Truss

i. Redundant Force

$$R = -\frac{\sum P\mu L / AE}{\sum \mu^2 L / AE}$$

ii. Internal Force

$F = P + \mu R$

4. Displacement

i. external load

$\Delta = \sum P\mu L / AE$

ii. temperature changers

$\Delta = \sum \mu c L t$

iii. fabrication error

$\Delta = \sum \mu \lambda$

5. Influence Lines

i. $R_A = 1 - x/L$, $R_B = x/L$

ii. $V_C = -x/L$, $R_A = 1 - x/L$

iii. $M_C = bx/L$, $V_C = a(1 - x/L)$